DOCUMENT RESUME

ED 164 339 SE 026 302

TITLE	Public Schools Energy Conservation Measures: Management Summaries.
INSTITUTION	American Association of School Administrators, Washington, D.C.
SPONS AGENCY	Federal Energy Administration, Washington, D.C.
PUB DATE	[78]
CONTRACT	FEA-CR-04-60711-00
NOTE	20p.; For related document, see SE 026 301; Not available in hard copy due to marginal legibility of original document
EDRS PRICE	MF-$0.83 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS	*Building Improvement; Building Operation; Climate Control; *Cost Effectiveness; *Demonstration Projects; Energy; *Energy Conservation; Environmental Research; Reports; *School Buildings; Simulation

ABSTRACT

This report is a summary of the first of five phases of a demonstration project of energy conservation school building modifications. The ten schools studied in this phase were selected as typical of the variations of building design, construction, and location for schools in this country. Given in this report are: (1) descriptions of the schools at each demonstration site including building characteristics and energy conservation recommendations; and (2) tables summarizing the costs and recovery rates of the recommended energy conservation options. (MR)

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ED164339

Public Schools Energy Conservation Measures

MANAGEMENT

SUMMARIES

BEST COPY AVAILABLE

SAVING SCHOOLHOUSE ENERGY

AMERICAN ASSOCIATION OF SCHOOL ADMINISTRATORS

SE 026 302

SAVING SCHOOLHOUSE ENERGY

The project, Saving Schoolhouse Energy, was initiated to demonstrate the desirability of modifying school buildings to achieve energy conservation, and to develop guidelines by which school administrators could identify the most cost-effective energy conserving opportunities in their buildings.

It should be stressed that the emphasis in this study is on cost-effective capital investments for energy conservation. In this type of study the recommended capital investments should not be implemented without first undertaking a comprehensive operational and maintenance program. This implies that sound energy management procedures, such as appropriate scheduling, periodic inspections, and routine maintenance are a continuing function. It further assumes that the human element--all building personnel and students--is cooperative and appreciative of the intent of the function desired.

The project is designed in five phases: (1) site selection and engineering analyses to identify and recommend cost-effective energy conserving opportunities; (2) architectural and design work; (3) installation, construction, or modifications to implement recommendations; (4) monitoring post-modification energy use to verify the projected energy savings; and (5) dissemination of the findings.

This publication summarizes the PRELIMINARY results of Phase 1. The Federal Energy Administration*, which funded this phase, is in the process of approving the final reports.

PHASE 1 -- MANAGEMENT SUMMARIES

PUBLIC SCHOOL ENERGY CONSERVATION MEASURES, REPORTS #1-10

A thorough and comprehensive engineering analysis of ten representative elementary schools across the nation was undertaken to identify cost-effective energy conserving opportunities. The reports of these studies are designed to provide school administrators, engineers, architects, and associated technical personnel with indicators of potential energy savers in similar buildings. The following information is a brief compilation of these findings and abbreviated management summaries of these ten reports.

The demonstration sites selected were constructed between 1925 and 1973, they were multi-level and single-story, and varied from double-loaded corridors to pod and open space schools; and they were widely dispersed geographically (Figure 1). Six of the schools used natural gas as a fuel source; two used oil; and two had gas/oil option. Fuel costs at the time

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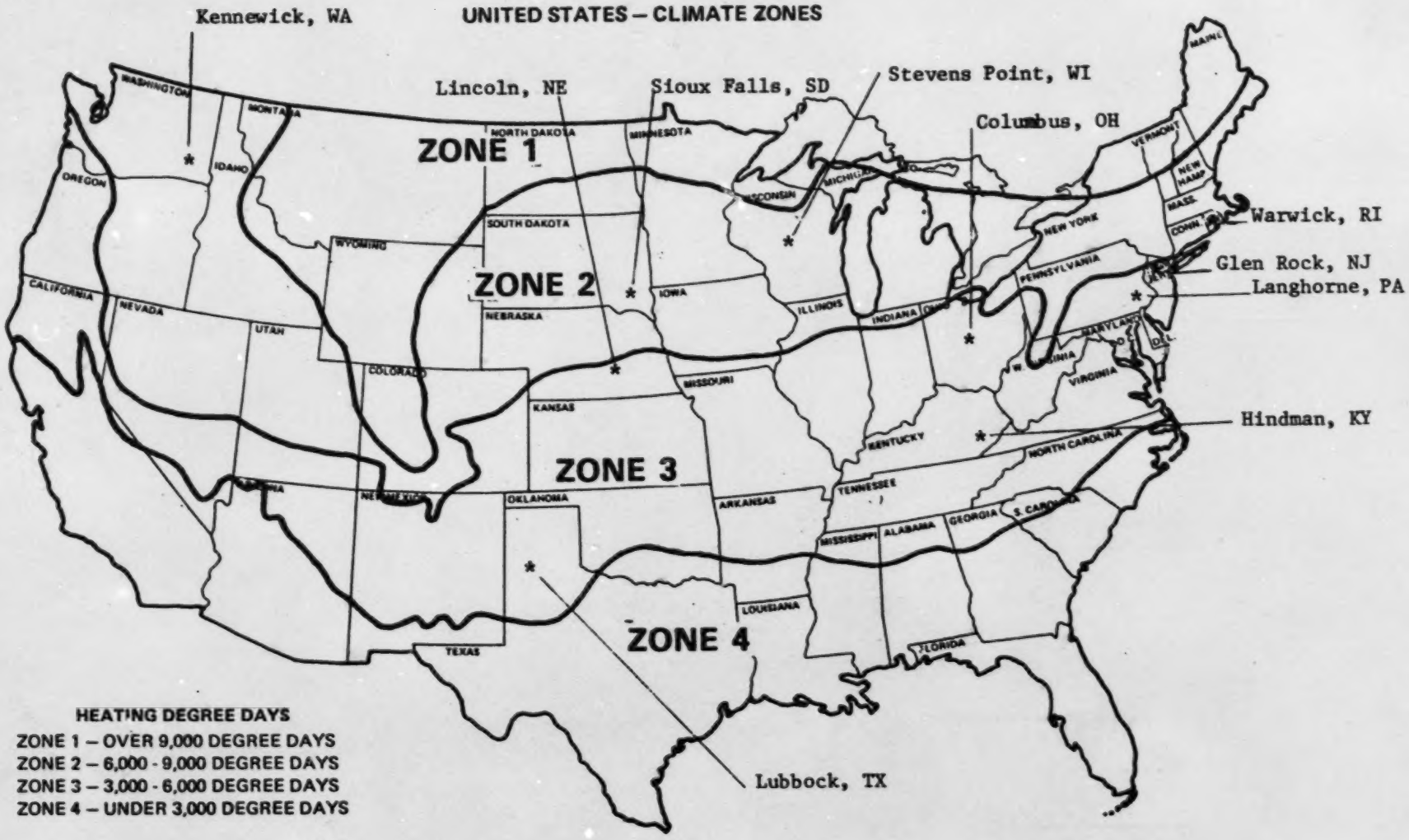
*Federal Energy Administration Contract No. CR-04-60711-00. The views and conclusions contained in this summary and in the engineering reports are those of the authors, and should not be interpreted as necessarily representing the official policies of the U.S. Government.

FIGURE 1. DEMONSTRATION SITES



studied ranged from $1.13/MCF to $3.36/MCF for natural gas and was approximately $0.34/gal for oil. All schools were heated; two used unit air conditioners; and one had central air conditioning. All ten schools operated on a standard school year.

Cost-effective energy conserving opportunities have been recommended for implementation at all sites. "Cost-effective" is defined as recovering the cost of investment within 12 years from the predicted energy savings. Calculations are based on current fuel costs with 10 percent per annum escalation adjusted for interest rates. By using the rather conservative 12-year payback period, the recommendations highlight the most cost-effective ECO's that should first be considered by school administrators -- remembering that school districts generally have very limited capital funds and must seek the most advantageous way to spend those funds.

Preliminary results show recommendations vary in cost by site from $1,000 to $80,425 with a mean recommended expenditure of $25,323. Preliminary projections suggest these expenditures will reduce energy consumption an average of 50 per cent across all ten sites. While modifications to the building envelope represent a significant portion of the total recommended expenditures, the most frequent recommendations were to adjust controls and to reduce outside air intake. Generally, they had the quickest recovery rate as well. Table 1 gives an overview of recommendations with associated capital cost estimates and recovery rates by site. Table 2 indicates the specific recommendations and estimated cost by site.

The recommendations made are for existing buildings with the characteristics as described. They offer guidelines for analyzing buildings with similar characteristics. However, suggested energy conserving opportunities must be weighed in terms of the fuel used, its cost and associated savings, as well as capital expenditure considerations. While it is not the primary intent of this report to address new construction concerns, the findings do have implications for such work.

It should also be noted that, in a free market, availability is reflected in cost. However, fuels have not had such a history. As long as fuel costs or supplies are in any way regulated, actual fuel availability may transcend the cost-effective characteristics of a modification.

As soon as the phase 1 engineering reports have been approved by the Federal Energy Administration they will be available at cost. An order blank is attached to this summary for your convenience. Inquiries related to the study should be addressed to:

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Saving Schoolhouse Energy
AASA
1801 No. Moore St.
Arlington, VA 22209

or to AASA's consulting engineer:
JCox Associates
Engineers-Consultants
245 West Maple Avenue
Vienna, VA 22180

Following the summary tables is a brief description of each school and more details on the energy conserving opportunities (ECOs) recommended. Also noted are ECOs studied but not recommended, at current fuel rates. As the cost of fuel exceeds the rate used in the calculations, such ECOs may become cost-effective and should be reviewed. Any reconsideration should not view adjusted energy and dollar savings in isolation; materials, labor, interest rates, etc. must also be assessed.

TABLE 1. Demonstration sites, related information; ECOs, associated cost, and recovery rate.

Report No.	School	Location	Year(s) built/ sq. ft.	Fuel	Cost-effective ECOs	Est. Cost	Recovery rate avg. yrs.
1	Scott	Warwick, R.I.	1965,67/ 27,610 (pod)	gas	1.reduce outside air 2.night setback 3.replace boiler 4.add roof insulation	$ 42,800	7
2	Central	Glen Rock, N.J.	1925,39,50/ 45,384	oil	1.reduce outside air 2.replace boiler 3.chg.temperature settings 4.dampers 5.roof insulation 6.reduce infiltration	39,550	6
3	Everitt	Langhorne, Pa.	1954,58,67/ 49,314	oil	1.reduce outside air 2.replace boiler	21,200	7
4	Hindman	Hindman, Ky.	1957,66/ 32,338	gas	1.increase boiler efficiency 2.reduce glass 60%	13,659	6.3
5	Fairmoor	Columbus, Ohio	1949,55/ 42,765	gas	1.shut down unit vents, summer 2.improve boiler efficiency 3.night setback 4.reduce outside air	25,700	3
6	P.F. Brown	Lubbock, Tex.	1949,50,56/ 36,802	gas	1.update & improve controls	1,000	1.5
7	Eastridge	Lincoln, Neb.	1954,55/ 32,029	gas/ oil	1.reset & rebalance air handling units 2.night setback	10,000	6
8	Garfield	Sioux Falls,N.D.	1952,56/ 33,700	gas/ oil	1.reduce outside air 2.night setback 3.improve boiler efficiency	20,000	8
9	Plover Whiting	Stevens Point, Wisc.	1973/44,000 (open space, CAC)	gas	1.improve air conditioning usage schedule 2.improve indoor lighting schedule 3.air temperature reset 4.reduce outside air	3,900	1
10	Washington	Kennewick, Wash.	1957/40,124	gas	1.mechanical adjustments 2.night setback 3.roof insulation 4.reduce glass 5.replace incandescent lighting	80,425	7.5

TABLE 2. Types of recommendations by site.

Given in cost/recovery rate, in years.

Site	Building Envelope			Lighting	Mechanical (HVAC Systems)						
					Boilers		A.C.	Controls			
	Insulate roof	Reduce glass	Infiltration		Improve efficiency	Replace		Reduce O.A.	Night Setback	Change Temp.	Adjust u.v., dampers, controls
1. Scott	$17,300/ 7					$19,500/9		$6,000/ 5	$0/I* ($1535)		
2. Central	7,200/ 7		$6,000/6 1,350/2 louvers			20,000/6		5,000/ 5		$0/I* ($565)	
3. Everitt						20,000/11		1200/ 2			
4. Hindman		$ 5600/7			←			↔ $ 8,059/5			→
5. Fairmoor					$10,000/3			7200/4	8500/3		Unoccupied shut down $0/I* (844)
6. Brown											1000/1.5
7. Eastridge									baseboard radiators 8000/8	2000/4	
8. Garfield					9,000/12			3000/3	8000/8		
9. Plover Whiting				Schedule $0/I* ($3214)			Schedule $0/I* (2934)	3000/3		900/6	
10. Washington	35,407/ 11.8	5447/4.2		Replace incandescent 29,571/ 9.38							10,000/ 3.08

* I for "immediate return. ( ) gives estimated first year savings.

ON-SITE CONSULTING ENGINEERS

ENGINEER		SCHOOLS
FLACK & KURTZ Consulting Engineers 29 West 38 Street New York, New York 10018	Site No. 1	Harold C. Scott Elementary Warwick, Rhode Island
	Site No. 2	Central Elementary School Glen Rock, New Jersey
	Site No. 3	Samuel Everitt Elementary Langhorne, Pennsylvania
LUCKETT & FARLEY, INC. Louisville, Kentucky	Site No. 4	Hindman Elementary School Hindman, Kentucky
JCOX ASSOCIATES 245 West Maple Vienna, Virginia 22180	Site No. 5	Fairmoor Elementary Columbus, Ohio
BRADY, FREEMAN & LOHRMAN Consulting Engineers 2001 Bryan Tower Suite 350 Dallas, Texas 75201	Site No. 6	P. F. Brown Lubbock, Texas
DENES NAGY & ASSOCIATES Consulting Engineers 740 North Rush Street Chicago, Illinois 60611	Site No. 7	Eastridge Elementary School Lincoln, Nebraska
	Site No. 8	Garfield Elementary School Sioux Falls, South Dakota
	Site No. 9	Plover Whiting Elementary Stevens Point, Wisconsin
VALENTINE, FISHER & TOMLINSON Seattle, Washington	Site No. 10	Washington Elementary School Kennewick, Washington

DEMONSTRATION SITE NO.1: Harold C. Scott Elementary School
Warwick, Rhode Island

Building Characteristics:

1965 single story pod or modified open space school -- 27,610 sq.ft. with library, multipurpose, and administration areas. Walls are 4" face brick, 4" loose insulation, and concrete block with approximately 22% single pane glass. Roof has 2 1/2" insulrock supported by steel beams.

The building is heated by natural draft gas-fired boilers. Unit ventilators are in all classrooms, library, and multipurpose area. Convectors, radiators, and cabinet heaters are used in offices, toilets, and corridors. Gas consumption averages (85 MBTU/sq.ft.)

Illumination is primarily fluorescent. KWH/sq.ft. for all electrical demands averages 3.88.

400 students, K-6; 25 staff. School day: 9:00 a.m.-3:00 p.m. School year: early September-late June.

Total Annual Energy Consumption: 89.6 MBTU/sq.ft. @ 5550 Deg. Days.

Energy Conserving Recommendations:

- Rebalance unit ventilators to reduce outside air 500 cfm to 250 cfm (R.I. code 10 cfm/stu)
  Estimated cost: $6,000. Recovery Rate: less than 5 yrs.
- Revise occupied/unoccupied cycle - from 4:00 a.m.-4:00 p.m. to 8:00 a.m. to 3:00 p.m.; override for night use
  Estimated cost: $0.00. Recovery Rate: immediate. Projected savings 1st year: $1,535
- Replace gas-fired boilers with oil-fired boilers
  Estimated cost: $19,500. Recovery rate: 9 years
- Add roof insulation during re-roofing
  Estimated Cost: $17,300. Recovery rate: 7 years

All recommendations: $42,800 (est.). Recovery: 7 years.

ECOs not recommended warranting future review: double glazing all windows

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DEMONSTRATION SITE NO. 2: Central Elementary School
Glen Rock, New Jersey

Building Characteristics:

Constructed 1925, 2 levels; 1939, one level addition similar construction. 45,384 sq. ft. Wall is 4" face brick, 2" air, 8" concrete block with plaster interior finish with 35% glass, double hung single pane. Roof is built up roofing over plywood deck; 3' drop in interior ceiling finished with plaster board or acoustical tile.

1958 addition is single level. Wall is 4 "face brick on 8" concrete block with 60% single pane casements. Roof is built up over wood sheathing with air space, 2" insulation and acoustical tile on interior surface.

Heated by (2) 1925 oil-fired low steam boilers (converted from coal). Unit ventilators and radiators in classrooms and auditorium. One pump for original structure and first addition; second pump for '58 addition -- controlled manually. Fuel consumption averages 0.94 gal/sq.ft.(131.6 MBTU/sq.ft.)

Illumination is primarily fluorescent. KWH/sq.ft. for all electrical demands averages 3.5.

300 Students, K-6; 30 staff (includes district administration personnel). School day 9:00 a.m.-3:00 p.m.; staff 8:00 a.m. to 6:00 p.m. School year: early September-late June. 15 adults 8:00 a.m.-6:00 p.m. in July. Vacated in August.

Total Annual Energy Consumption: 158 MBTU/sq.ft. @ 4590 Deg. Days.

Energy Conserving Recommendations:

- Reduce outside air
  --500 cfm to 175 cfm (state code)
  Estimated cost: $5,000. Recovery rate: 5 years
- Replace boiler with modular hot water boilers
  Estimated cost: $20,000. Recovery rate: 6 years.
- Reduce thermostat settings: 70 F to 68 F
  Estimated cost: $0.00 (maintenance). Recovery rate: immediate. Estimated savings 1st year: $565.00
  Install motor operated damper to close louvers and roof ventilators in auditorium
  Estimated cost: $1,350. Recovery rate: 2 years.
- Install roof insulation: -- blanket type in existing 3' airspace. Estimated cost: $7,200. Recovery rate: 7 years.
- Infiltration reductions:
  --weather stripping windows and doors
  --automatic damper at roof ventilator
  Estimated cost: $6,000. Recovery rate: 6 years.

All recommendations: $39,550 (est.). Recovery rate: 6 years

ECOs not recommended warranting future review: institute warm-up cycle with dampers closed.

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DEMONSTRATION SITE NO. 3: Samuel Everitt Elementary School
Langhorne, Pennsylvania

Building Characteristics:

Constructed 1954 with two additions (1958, 1967); all have similar structure. 49,314 sq.ft. Walls are 4" face brick, air space, and 8" concrete block with approximately 45% glass in single pane casements. It has a built-up roof over 3 1/2" Insulrock supported by exposed steel beams.

Heated by (2) oil-fired hot water boilers. There is a 5.5 ton air conditioning unit for office area controlled by a 7 day time clock and two manually controlled window air conditioners for the library. Unit ventilators and radiators are used throughout the building. Fuel consumption .68 gals/sq.ft. (93.8 MBTU/sq.ft.).

Illumination is primarily fluorescent. KWH/sq.ft. for all electrical demand averages 3.27.

Everitt has 559 students, K-5. School day: 9:00 a.m. to 3:00 p.m. School year: early September to Mid-June. Used five nights per week and the office all summer.

Total Annual Energy Consumption: 108.9 MBTU/sq.ft. @ 4590 Deg. Days.

Energy Conserving Recommendations:

- Reduce outside air intake
  --500 cfm to 175 cfm (state req.)
  Estimated cost: $1,200. Recovery rate: 2 years.
- Replace boilers with modular hot water boilers
  Estimated cost: $20,000. Recovery rate: 11 years.

All recommendations: $21,200 (est.). Recovery rate: 7 years

ECOs not recommended warranting future review: double pane glass, and/or panel over clearstory glass.

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DEMONSTRATION SITE NO. 4: Hindman Elementary School
Hindman, Kentucky

Constructed in 1957 with addition of similar structure in 1966. Walls are 4" face brick, 2" air space, and 4" concrete block with 49% glass of 1/8" plate glass with aluminum frame. The roof is 1 1/2" rigid insulation, air space, and 2 3/4" blanket fiberglass on steel deck. Total area is 32,338 sq.ft.

Hindman is heated by a gas-fired cast iron sectional boiler with forced hot water circulating through convectors. Four sections were added in 1966 to accomodate addition. Classrooms do not have thermsotats. Building is controlled by zone of exposure. Annual fuel consumption .8CCF/sq.ft. (80 MBTU/sq.ft.).

Illumination is primarily fluorescent with level at approximately 60 foot-candles. Annual electrical consumption 2.58 KWH/sq.ft.

611 students, 1-7, and 32 staff occupy building from 8:30 a.m. to 3:30 p.m. 180 days, mid-August to mid-May.

Total Annual Fuel Consumption: 88.4 MBTU/sq.ft. @ 3320 Deg. Days.

Energy Conserving Recommendations:

- Increase boiler efficiency to 80%, reduce outside air, and repair zone control
  --clean, adjust boiler; establish appropriate controls
  --set unit ventilators for reduced outside air; close dampers on night set back
  repair and correct zone thermostats and 3-way valves
  Estimated cost: $8,059. Recovery rate: 5 years.
- Reduce glass by 60%.
  Estimated cost: $5,600. Recovery rate: 7 years.

All recommendations: $13,659 (est.). Recovery rate: 6.3 years

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DEMONSTRATION SITE NO. 5: Fairmoor Elementary
Columbus, Ohio

Original structure build in 1949 was 23,500 sq.ft. on 3 levels. The walls are 4" brick face on 8" concrete block with 28% glass, N/S facing. Roof was rehabilitated 3 years ago with 2 1/2" insulating board on steel deck.

A 19,200 sq.ft. addition was added in 1955 bringing total square footage to 43,765 sq.ft. The addition is a single level. The walls are 4" brick face on 12" concrete block with 58% glass, E/W facing. The addition roof consists of built up roofing on 2 1/2" Tectum panels with no ceilings.

Fairmoor is heated by 2 gas-fired boilers converted from coal. There are unit ventilators in all classrooms -- steam in original section, hot water in addition. Therms/sq.ft. averages 1.5. (150 MBTU/sq.ft.).

Illumination is primarily fluorescent with mercury vapor and incandescent in multipurpose room. Electricity demand is 3.56 KWR/sq.ft.

475 students, K-6 and 30 staff occupy the building 8:45 a.m. to 3:15 p.m. from early September to mid-June.

Total Annual Energy Consumption: 180.6 MBTU/sq.ft. @ 5280 Deg. Days.

Energy Conserving Recommendations:

- Shut down unit ventilators in unoccupied summer months
  Estimated cost: $0.00. Recovery rate: immediate ($844 1st year)
- Improve boiler efficiency
  --replace burners
  --reduce flue size
  --install boiler controls to fire on demand
  Estimated cost: $10,000. Recovery rate: 4 years.
- Night set back
  --install time clock to shut unit ventilators, close dampers, stop exhaust fans
  Estimated cost: $8,500. Recovery rate: 3 years.
- Adjust unit ventilators to reduce outside air intake
  --air balance; upgrade controls
  Estimated cost: $7,200. Recovery rate: under 4 years.

All recommendations: $25,700 (est.). Recovery rate: under 3 years

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ECOs not recommended warranting future review: double glazing, insulate addition roof, add double doors, or reduce glass.

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DEMONSTRATION SITE NO. 6: P. F. Brown
Lubbock, Texas

Original 1949 structure and 1950 addition comprise 25,258 sq.ft. single level. Of similar construction - walls are 4" face brick on 8" structural tile with interior plastered with 16.5% glass, N/S facing. Roof is 3" concrete deck, ceiling plastered.

1956 addition brought total footage to 36,802 sq.ft. This addition is essentially the same with the exception of acoustical board on ceiling and the double hung windows have an E/W orientation.

P. F. Brown has one gas-fired, fire tube, low pressure steam boiler. There are no unit ventilators. Outside air by infiltration only. Gas consumption averages 0.91 MCF/sq.ft. (91 MBTU/sq.ft.).

Illumination is primarily fluorescent. Total electrical demand averages 2.185 KWH/sq.ft

388 students, K-6, and 48 staff occupy the building 8:00 a.m. to 3:00 p.m. late August through May.

Total Annual Energy Consumption: 102.5 MBTU/sq.ft. @ 3150 Deg. Days.

Energy Conserving Recommendations:

- Update and improve controls

Estimated cost: $1,000. Recovery rate: 1.5 years

ECOs not recommended warranting future reveiw: increase efficiency of heating plant.

Adding roof insulation, replacing glass blocks, and contracting weather stripping all had recovery rates over 50 years.

# # # #

DEMONSTRATION SITE NO. 7: Eastridge Elementary School
Lincoln, Nebraska

Constructed in 1954 and added in 1955, Eastridge has essentially the same structure. Walls are 4" brick on 4" cavity block with 4" face brick veneer. Glass is single pane clear and frosted above, 27% of wall with predominance N/S facing. Roof is built up tar and gravel on 3 1/2" cedar deck, 3/4" acoustical tile ceiling.

Eastridge is heated by 2 gas/oil fired hot water boilers. It has hot water baseboard radiators and hot water central air handling units.

Annual fuel consumption: .71 CCF/sq.ft. (71 MBTU/sq.ft.).

Illumination is fluorescent. Annual electric 3.7 KWH/sq.ft.

300 students, K-6, occupy the building from 8:40 a.m. to 2:40 p.m.; 25 staff members from 8:00 a.m.-4:30 p.m. for 178 days each year.

Total Annual Energy Consumption: 83 MBTU/sq.ft. @ 6040 Deg. Days.

Energy Conserving Recommendations:

- Resetting and rebalancing air handling unit
  Estimated cost: $2,000. Recovery rate: 4 years
- Night set back for baseboard radiation
  Estimated Cost: $8,000. Recovery rate: 8 years

Estimated cost: $10,000. Recovery rate: 6 years

ECOs not recommended warranting future review: add roof insulation, reduce glass by 17%, or add exterior wall insulation.

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DEMONSTRATION SITE NO. 8: Garfield Elementary School
Sioux Falls, South Dakota

Constructed in 1952 and added to in 1956 for a total of 33,700 sq.ft. Garfield has two levels. Walls are 4" face brick on 8" concrete block with about 30% glass. Of this glass area, 70% is glass block and the remainder is plate. The roof is 4 ply pitch and felt, 2" semi-rigid insulation, and 1 1/2" metal deck.

Garfield is heated by 2 gas/oil fired hot water boilers. Hot water baseboards and hot water central air handling units handle the heating and ventilating requirements. Annual fuel consumption: 94 CCF/sq.ft. (94 MBTU/sq.ft.).

Illumination is primarily fluorescent. Annual electric usage 3.08 KWH/sq.ft.

500 students, K-6, occupy the building 8:30 a.m. to 3:15 p.m.; 26 full time and 8 part time staff are there from 8:30 a.m. to 4:00 p.m. for 180 days per year.

Total Annual Energy Consumption: 109.7 MBTU/sq.ft. @ 7860 Deg. Days.

Energy Conserving Recommendations:

- Reduce outside air to minimum code (5 cfm)
  Estimated cost: $3,000. Recovery rate: 3 years
- Night set back system
  Estimated cost: $8,000. Recovery rate: 8 years
- Improve boiler efficiency
  Estimated cost: $9,000. Recovery rate: 12 years

All recommendations: $20,000 (est.). Recovery rate: 8 years

ECOs not recommended warranting future review: add roof insulation, add exterior wall insulation, or reduction of glass.

# # # #

DEMONSTRATION SITE NO. 9: Plover Whiting Elementary School
Stevens Point, Wisconsin

Plover Whiting is an open space school of 44,000 sq.ft. constructed in 1973. It has three distinct wall types: (1) 3/8" diagonal wood siding, 1" rigid insulation, 3/4" air space, and 8" concrete block; (2) as "1" with 12" concrete block around gym; and (3) 3/8" wood siding, 3/8" gypsum sheathing, 2" air space, 3 1/2" batt insulation on 6" stud wall with 5/8" GWB on interior. Glass averages 6.9%. Roof is built up, 1 1/2" rigid insulation, 1 1/2" metal deck, and 3/4" acoustical ceiling tile.

Plover Whiting is heated/cooled by 2 forced draft gas-fired boilers and 120 ton reciprocating chiller with air cooled condensing. Classrooms and multi-purpose are heated, ventilated and air conditioned by 3 central air handling units. Uses average .9 therms/sq.ft. (90 MBTU/sq.ft.).

Illumination is primarily fluorescent. Electrical load demand is approximately 10.5 KWH/sq.ft.

472 students, K-6, and 28 staff occupy the building from 9:00 a.m. to 3:30 p.m. for approximately 180 days, late August to mid-June.

Total Annual Energy Consumption: 132 MBTU/sq.ft. @ 7590 Deg. Days.

Energy Conserving Recommendations:

- Improve air conditioning usage schedule
  Estimated cost: $0.00. Recovery rate: immediate ($2,934 1st year)
- Improve indoor lighting usage schedule
  Estimated cost: $0.00. Recovery rate: immediate ($3,214 1st year)
- Air temperature reset mixed and supply
  Estimated cost: $900. Recovery rate: 6 years
- Reduce outside air intake to minimum code (5 cfm/person)
  --rebalance outside, return, and exhaust dampers
  Estimated cost: $3,000. Recovery rate: 3 years

All recommendations: $3,900 (est.)
Recovery rate (investments only): 2 years
all recommendations: 8 months.

ECOs not recommended warranting future review: add roof insulation and/or add wall insulation.

# # # #

DEMONSTRATION SITE NO. 10: Washington Elementary School
Kennewick, Washington

Washington is a single level structure built in 1957 with no addition. The three wing double loaded corridors has a total area of 40,124 sq.ft. Walls are precast panels and 3/4" rigid insulation with 50% glass (1/4" plate). The roof is built up roofing with 2" rigid insulation on steel deck with 2% sky-light.

Heating is by a gas-fired induced draft steel boiler. Distribution is on 3 zones with unit ventilators in classrooms, multipurpose, and administrative areas. Consumption averages .87 therms/sq.ft. (86.9 MBTU/sq.ft.).

Illumination is incandescent throughout. Total electrical demand is approximately 6.14 KWH/sq.ft.

503 students, K-6, occupy the building 9:00 a.m. to 3:15 p.m. and the staff from 8:00 a.m. to 3:45 p.m. from early September to mid-June.

Total Annual Energy Consumption: 107.8 MBTU/sq.ft. @ 5300 Deg. Days.

Energy Conserving Recommendations:

- Mechanical adjustments and maintenance
  --bring outside air up to code (5 cfm)
  --bring pump, filters, coils, fan motors, and damper linkages to maximum efficiency
  --calibrate and reduce thermostat settings
  --provide night setback capability
  Estimated cost: $10,000. Recovery rate: 3.08 years
- Add roof insulation in re-roofing process
  --3" rigid insulation
  Estimated cost: $35,407. Recovery rate: 11.8 years
- Reduce glass by 28% - fixed window modules with N, E or W exposure
  Estimated cost: $5,447. Recovery rate: 4.2 years
- Replace incandescent lighting with fluorescent at code (50 classroom, 20 corridors)
  Estimated cost: $29,571. Recovery rate: 9.38 years

All recommendations: $80,425 Recovery rate: 7.5 years

ECOs not recommended warranting future review: change from gas-fired to electric boiler.

ORDER FORM

Public School Energy Conserving Measures

Report No.

1. SCOTT: *1965,67 pod; replace boilers, add roof insulation, controls ($37,800/5 yr. return)* _____
2. CENTRAL: *1925,39,50; replace boilers, roof insulation, reduce infiltration, controls ($39,550/5 yr. return)* _____
3. EVERITT: *1954,58,67; replace boiler, reduce outside air ($21,200/9 yr. return)* _____
4. HINDMAN: *1957,66; increase boiler efficiency, reduce outside air, night set back, controls, reduce glass 60% ($13,659/6.3 yr. return)* _____
5. FAIRMOOR: *1949,55; improve boiler efficiency, revise unoccupied settings, reduce outside air, night set back ($25,700/3 yrs. return)* _____
6. P.F. BROWN: *1949,50,56; update and improve controls ($1000/1.5 yr. return)* _____
7. EASTRIDGE: *1954,55; reset and rebalance air handling units; night set back ($10,000/5 yr. return)* _____
8. GARFIELD: *1952,56; reduce outside air, night set back, improve boiler efficiency ($20,000/10 yr. return)* _____
9. PLOVER WHITING: *1973; air condition schedule, indoor lighting schedule, air temperature reset, reduce outside air ($3,900/1 yr. return)* _____
10. WASHINGTON: *mechanical adjustments, night set back, roof insulation, reduce glass, replace incandescent lighting ($80,425/7.5 yr. return)* _____

No. Reports Requested _____

Each report at cost ($2.50) including postage and handling as soon as cleared by Federal Energy Administration.

Enclosed is $_____(# reports X $2.50)

Make check payable to AASA-Energy and mail to:

Dr. Shirley J. Hansen
AASA-OGR
1801 North Moore Street
Arlington, VA. 22209